9th Class 2019

Math (Science)	Group-II	Paper-I
Time: 2.10 Hours	(Subjective Type)	Max. Marks: 60

(Part-I)

2. Write short answers to any Six (6) questions: 12

(i) Find the product:

$$\begin{bmatrix} 2 & 3 \\ 1 & 1 \\ 0 & -2 \end{bmatrix}\begin{bmatrix} 2 & -1 \\ 3 & 0 \end{bmatrix}$$

Ans

$$\begin{bmatrix} 2 & 3 \\ 1 & 1 \\ 0 & -2 \end{bmatrix}\begin{bmatrix} 2 & -1 \\ 3 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 2(2)+3(3) & 2(-1)+3(0) \\ 1(2)+1(3) & 1(-1)+1(0) \\ 0(2)+(-2)(3) & 0(-1)+-2(0) \end{bmatrix}$$

$$= \begin{bmatrix} 4+9 & -2+0 \\ 2+3 & -1+0 \\ 0-6 & 0+0 \end{bmatrix}$$

$$= \begin{bmatrix} 13 & -2 \\ 5 & -1 \\ -6 & 0 \end{bmatrix}$$

(ii) If $2\begin{bmatrix} 2 & 4 \\ -3 & a \end{bmatrix} + 3\begin{bmatrix} 1 & b \\ 8 & -4 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix}$ **then find the values of a and b.**

Ans Given,

$$2\begin{bmatrix} 2 & 4 \\ -3 & a \end{bmatrix} + 3\begin{bmatrix} 1 & b \\ 8 & -4 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 2(2) & 2(4) \\ 2(-3) & 2(a) \end{bmatrix} + \begin{bmatrix} 3(1) & 3(b) \\ 3(8) & 3(-4) \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 4 & 8 \\ -6 & 2a \end{bmatrix} + \begin{bmatrix} 3 & 3b \\ 24 & -12 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 4+3 & 8+3b \\ -6+24 & 2a-12 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 7 & 8+3b \\ 18 & 2a-12 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix}$$

As both matrices are equal, so their corresponding entries must also be equal. Thus, by comparing both sides, we get

$$8 + 3b = 10 \qquad (1)$$

$$2a - 12 = 1 \qquad (2)$$

From (1); $8 + 3b = 10$

$$3b = 10 - 8$$

$$3b = 2$$

$$b = \frac{2}{3}$$

From (2); $2a - 12 = 1$

$$2a = 1 + 12$$

$$2a = 13$$

$$a = \frac{13}{2}$$

(iii) Give a rational number between $\frac{3}{4}$ and $\frac{5}{9}$.

Ans Number between $\frac{3}{4}$ and $\frac{5}{9}$

$$= \frac{\frac{3}{4} + \frac{5}{9}}{2} = \frac{\frac{27+20}{36}}{2} = \frac{47}{72}$$

(iv) Simplify: $(x^3)^2 \div x^3$

Ans Given: $(x^3)^2 \div x^3$

$$= \frac{x^{3\times 2}}{x^3}$$

$$= x^6 . x^{-3}$$

$$= x^{6-3}$$

$$= x^3$$

(v) Express the number 0.0074 in scientific notation.

Ans Given the number = 0.0074

In scientific notation:

$= 0.0074 \times \frac{1000}{1000}$

$= (0.0074 \times 1000) \times \frac{1}{1000}$

$= (7.4) \times \frac{1}{10^3}$

$= 7.4 \times 10^{-3}$

(vi) Calculate $\log_3 2 \times \log_2 81$.

Ans $= \frac{\log_2}{\log_3} \times \frac{\log_{81}}{\log_2}$

$= \frac{\log_{81}}{\log_3} = \frac{\log 3^4}{\log_3}$

$= 4\frac{\log_3}{\log_3} = 4$

(vii) Evaluate $\frac{3x^2\sqrt{y}+6}{5(x+y)}$ if $x = -4$ and $y = 9$.

Ans By putting the values in the given expression:

$$\frac{3x^2\sqrt{y}+6}{5(x+y)} = \frac{3(-4)^2\sqrt{9}+6}{5(-4+9)}$$

$$= \frac{3(16)(3)+6}{5(5)}$$

$$= \frac{144+6}{25}$$

$$= \frac{150}{25} = 6$$

(viii) If $x = 4-\sqrt{17}$, find the value of $\frac{1}{x}$.

Ans Given, $x = 4-\sqrt{17}$

$$\frac{1}{x} = \frac{1}{4-\sqrt{17}}$$

By rationalization, we have

$$= \frac{1}{4-\sqrt{17}} \times \frac{4+\sqrt{17}}{4+\sqrt{17}}$$

$$= \frac{1(4+\sqrt{7})}{(4-\sqrt{17})(4+\sqrt{17})}$$

$$= \frac{4+\sqrt{17}}{(4)^2-(\sqrt{17})^2}$$

$$= \frac{4+\sqrt{17}}{16-17}$$

$$= \frac{4+\sqrt{7}}{-1}$$

$$\frac{1}{x} = -4-\sqrt{17}$$

(ix) Factorize: $\mathbf{x(x-1)-y(y-1)}$

Ans

$$x(x-1)-y(y-1)$$
$$= x^2-x-y^2+y$$
$$= x^2-y^2-x+y$$
$$= (x^2-y^2)-(x-y)$$
$$= (x+y)(x-y)-(x-y)$$
$$= (x-y)[(x+y)-1]$$
$$= (x-y)(x+y-1)$$

3. Write short answers to any Six (6) questions: 12

(i) Use factorization to find the square root of:

$$\frac{1}{16}x^2-\frac{1}{12}xy+\frac{1}{36}y^2$$

Ans Given: $\frac{1}{16}x^2-\frac{1}{12}xy+\frac{1}{36}y^2$

By factorization:

$$= \left(\frac{1}{4}x\right)^2 - 2\left(\frac{1}{4}x\right)\left(\frac{1}{6}y\right)+\left(\frac{1}{6}y\right)^2$$

$$= \left(\frac{1}{4}x-\frac{1}{6}y\right)^2$$

$$= \left(\frac{1}{4}x-\frac{1}{6}y\right)\left(\frac{1}{4}x-\frac{1}{6}y\right)$$

(ii) Define a linear inequality in one variable.

Ans A linear inequality in one variable x is an inequality in which the variable x occurs only to the first power and is of the form.

$$ax + b < 0, a \neq 0$$

where a and b are real numbers. We may replace the symbol < by >, ≤ or ≥.

(iii) Solve the inequality: $3x + 1 < 5x - 4$.

Ans

$$3x + 1 < 5x - 4$$
$$3x + 1 - 5x < 5x - 4 - 5x$$
$$-2x + 1 < -4$$
$$-2x + 1 - 1 < -4 - 1$$
$$-2x < -5$$

Dividing by -2

$$\frac{-2x}{-2} < \frac{-5}{-2}$$

$$x > \frac{5}{2} \quad \text{(change of sign)}$$

(iv) Define co-ordinate axes.

Ans The plane formed by two straight lines perpendicular to each other is called cartesian plane and the lines are called coordinate axes.

(v) Verify whether the point (2, 3) lies on the line $2x - y + 1 = 0$ or not.

Ans

$$2x - y + 1 = 0$$
$$-y = -2x - 1$$
$$y = 2x + 1$$

As the points (2, 3) lie on the given line so put $x = 2$ and $y = 3$ in the given line

$$3 = 2(2)^2 + 1$$
$$3 = 4 + 1$$
$$3 = 5 \text{ impossible}$$

So, the points (2, 3) does not lie on the line.

(vi) Define isosceles triangle.

Ans An isosceles triangle is a triangle which has two of its sides with equal length while the third side has a different length.

(vii) Find the distance between the pair of points:

A(9, 2), B(7, 2)

Ans The distance formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

From the above points,

$$x_1 = 9, x_2 = 7, y_1 = 2, y_2 = 2$$

By putting the values in the distance formula:

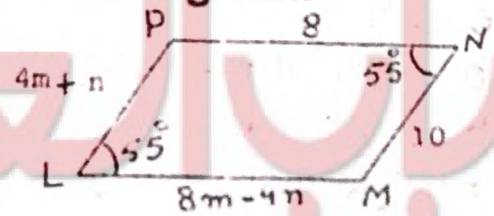
$$d = \sqrt{(7-9)^2 + (2-2)^2}$$
$$= \sqrt{(-2)^2 + (0)^2}$$
$$= \sqrt{4}$$
$$d = 2$$

(viii) State H.S postulate.

Ans According to H.S postulate:

If in the correspondence of the two right angled triangles, the hypotenuse and one side of one triangle are congruent to the hypotenuse and the corresponding side of the other, then the triangles are congruent.

(ix) LMNP is a parallelogram.



Find the value of "m" and "n".

Ans From opposite sides of ||

$$4m + n = 10 \quad (1)$$
$$8m - 4n = 8 \quad (2)$$

Multiplying equ (1) by '4' and adding in equ (2)

$$16m + 4n = 40$$
$$8m - 4n = 8$$
$$24m = 48$$
$$m = \frac{48}{24}$$
$$\boxed{m = 2}$$

By putting m = 2 in equ (1), we get:

$$4(2) + n = 10$$
$$8 + n = 10$$
$$n = 10 - 8$$
$$\boxed{n = 2}$$

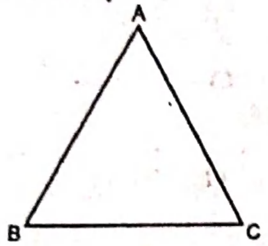
4. Write short answers to any Six (6) questions: 12

(i) Define bisector of an angle.

Ans Bisector of an angle is the ray which divides an angle into two equal parts.

(ii) 3 cm, 4 cm and 7 cm are not the lengths of a triangle. Give the reason.

Ans A triangle has the shape



Let $m\overline{AB} = 7$ cm

$m\overline{BC} = 4$ cm

$m\overline{CA} = 3$ cm

Now, we check why these are not lengths of the triangle.

1. $m\overline{AB} + m\overline{BC} > m\overline{CA}$

$7 + 4 > 3$

$11 > 3$

2. $m\overline{BC} + m\overline{CA} > m\overline{AB}$

$4 + 3 > 7$

$7 > 7$ (Not possible)

3. $m\overline{CA} + m\overline{AB} > m\overline{BC}$

$3 + 7 > 7$

$10 > 7$

As part (ii) is not possible, so 7 cm, 4 cm and 3 cm are not the sides of a triangle.

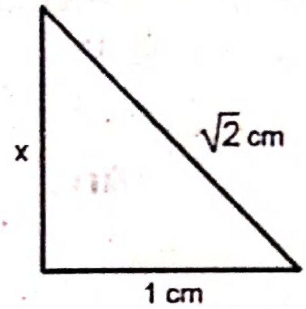
(iii) Define proportion.

Ans Equality of two ratios is defined as proportion.

(iv) State Pythagoras theorem.

Ans In a right angled triangle, the square of the length of hypotenuse is equal to the sum of the squares of the lengths of the other two sides.

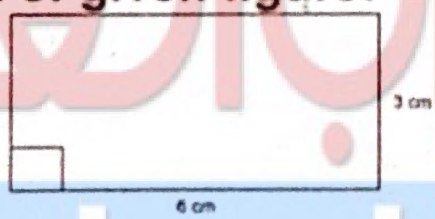
(v) Find unknown value of x in given figure:



Ans Let the above triangle is ΔABC. So, In right angled ΔABC, by Pythagoras Theorem:

$$(m\overline{AC})^2 = (m\overline{AB})^2 + (m\overline{BC})^2$$
$$(\sqrt{2})^2 = (x)^2 + (1)^2$$
$$2 = x^2 + 1$$
$$2 - 1 = x^2$$
$$\Rightarrow \quad x^2 = 1$$
$$\sqrt{x^2} = \sqrt{1}$$
$$x = 1 \text{ cm}$$

(vi) Find the area of given figure:



Ans Length of the rectangle = 6 cm
Width of the rectangle = 3 cm
Area of the rectangle = Length × Width
$= 6 \times 3$
$= 18 \text{ cm}^2$

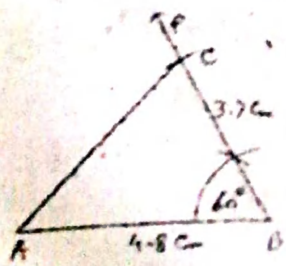
(vii) State congruent area axiom.

Ans If $\Delta ABC \cong \Delta PQR$, then
area of (region ΔABC) = area of Δ (region ΔPQR).

(viii) Construct a triangle ABC in which:

$$m\overline{AB} = 4.8 \text{ cm}, \; m\overline{BC} = 3.7 \text{ cm}, \; m\angle B = 60^\circ$$

Ans



Steps of Construction:

1. Take a line segment $\overline{AB} = 4.8$ cm.
2. Make an angle of 60° at B.
3. Cut off $\overline{BC} = 3.7$ cm from $\overrightarrow{BP}$.
4. Join C to A.

ABC is the required triangle.

(ix) Define orthocentre of a triangle.

Ans Orthocentre of a triangle means the point of concurrency of three altitudes of a triangle.

(Part-II)

NOTE: Attempt THREE (3) questions in all. But question No. 9 is Compulsory.

Q.5.(a) Solve the system of linear equations by using matrix inversion method: (4)

$$3x - 4y = 4, x + 2y = 8$$

Ans

$$3x - 4y = 4$$
$$x + 2y = 8$$

$$\begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 8 \end{bmatrix}$$

$$AX = B$$

$$X = A^{-1}B \qquad (1)$$

Where $A^{-1} = \frac{1}{|A|}\text{Adj }A$

So, $|A| = \begin{vmatrix} 3 & -4 \\ 1 & 2 \end{vmatrix}$

$$= 3(2) - 1(-4)$$
$$= 6 + 4$$
$$= 10$$

$$\text{Adj }A = \begin{bmatrix} 2 & 4 \\ -1 & 3 \end{bmatrix}$$

$$A^{-1} = \frac{1}{10}\begin{bmatrix} 2 & 4 \\ -1 & 3 \end{bmatrix}$$

By putting the values of A^{-1} and B in (1), we get

$$X = A^{-1}B$$

$$X = \frac{1}{10}\begin{bmatrix} 2 & 4 \\ -1 & 3 \end{bmatrix}\begin{bmatrix} 4 \\ 8 \end{bmatrix}$$

$$= \frac{1}{10}\begin{bmatrix} 2(4) + 4(8) \\ -1(4) + 3(8) \end{bmatrix}$$

$$= \frac{1}{10}\begin{bmatrix} 8 + 32 \\ -4 + 24 \end{bmatrix}$$

$$= \frac{1}{10}\begin{bmatrix} 40 \\ 20 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{40}{10} \\ \frac{20}{10} \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 2 \end{bmatrix}$$

Thus, the solution set is

$$\{x = 4, \quad y = 2\}$$

(b) Show that: $\left(\frac{x^a}{x^b}\right)^{a+b} \times \left(\frac{x^b}{x^c}\right)^{b+c} \times \left(\frac{x^c}{x^a}\right)^{c+a} = 1$ **(4)**

Ans For Answer see Paper 2018 (Group-I), Q.5.(b).

Q.6.(a) Use log table to find the value of: **(4)**

$$\frac{0.678 \times 9.01}{0.0234}$$

Ans For Answer see Paper 2018 (Group-II), Q.6.(a).

(b) If $p = 2 + \sqrt{3}$, find $p^2 + \frac{1}{p^2}$. **(4)**

Ans Given, $p = 2 + \sqrt{3}$

$$\frac{1}{p} = \frac{1}{2 + \sqrt{3}}$$

$$= \frac{1}{2 + \sqrt{3}} \times \frac{2 - \sqrt{3}}{2 - \sqrt{3}} \quad \text{By Rationalization:}$$

$$= \frac{1(2 - \sqrt{3})}{(2 + \sqrt{3})(2 - \sqrt{3})}$$

$$= \frac{2 - \sqrt{3}}{(2)^2 - (\sqrt{3})^2}$$

$$= \frac{2 - \sqrt{3}}{4 - 3}$$

$$\frac{1}{p} = 2 - \sqrt{3}$$

$$p + \frac{1}{p} = (2 + \sqrt{3}) + (2 - \sqrt{3})$$

$$= 2 + \sqrt{3} + 2 - \sqrt{3}$$

$$= 4$$

$$\left(p + \frac{1}{p}\right)^2 = (4)^2$$

$$p^2 + \frac{1}{p^2} + 2 = 16$$

$$p^2 + \frac{1}{p^2} = 16 - 2$$

$$\boxed{p^2 + \frac{1}{p^2} = 14}$$

Q.7.(a) If $(x - 1)$ is a factor of $x^3 - kx^2 + 11x - 6$, then find the value of k. **(4)**

Ans Put $x - 1 = 0$

$$x = 1$$

Given expression,

$$P(x) = x^3 - kx^2 + 11x - 6$$

$$P(1) = (1)^3 - k(1)^2 + 11(1) - 6$$

$$= 6 - k$$

For the value of k:

$$6 - k = 0$$

$$6 = k$$

$$\Rightarrow \quad \boxed{k = 6}$$

(b) Find the square root of: **(4)**

$$4x^4 + 12x^3 + x^2 - 12x + 4$$

Ans For Answer see Paper 2018 (Group-I), Q.7.(b).

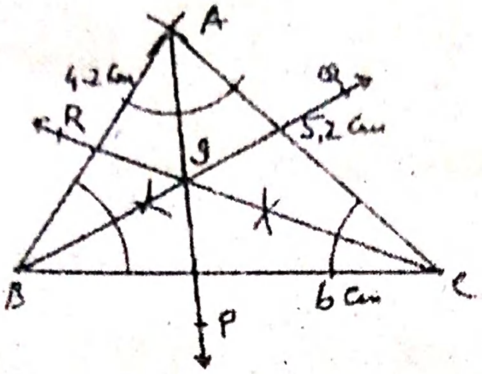
Q.8.(a) Solve the equation: $\frac{5(x-3)}{6} - x = 1 - \frac{x}{9}$ **(4)**

Ans For Answer see Paper 2017 (Group-II), Q.8.(a).

(b) Construct the ΔABC, and draw the bisectors of its angles: (4)

$m\overline{AB} = 4.2$ cm, $m\overline{BC} = 6$ cm and $m\overline{CA} = 5.2$ cm

Ans



Steps of Construction:

(i) Take a line segment $\overline{BC} = 6$ cm.

(ii) Take B as center and draw an arcs of 4.2 cm radius.

(iii) Take C as centre and draw an arc of 5.2 cm radius that cuts the first arc at point A.

(iv) Join A to B and C.

ΔABC is the required triangle.

(v) Take $\overrightarrow{AP}$, $\overrightarrow{BQ}$ and $\overrightarrow{CR}$ bisectors of angle A, B and C respectively.

$\overrightarrow{AP}$, $\overrightarrow{BQ}$, $\overrightarrow{CR}$ are concurrent at point I.

Q.9. Prove that the right bisectors of the sides of a triangle are concurrent. **(8)**

Ans For Answer see Paper 2014 (Group-I), Q.9.

OR

Prove that parallelograms on equal bases and having the same (or equal) altitude are equal in area.

Ans For Answer see Paper 2017 (Group-I), Q.9.(OR).